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Higgins et al.

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(54) **SLIDING DOOR OBSTACLE DETECTION**

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(51) **Int. Cl.**

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B60Q 9/00	(2006.01)
E05B 81/64	(2014.01)
E05B 83/36	(2014.01)
E05F 15/646	(2015.01)

(52) **U.S. Cl.**

CPC ***E05F 15/40*** (2015.01); *Y10T 16/545* (2015.01); ***B60Q 9/00*** (2013.01); *E05Y 2400/54* (2013.01); *E05Y 2900/531* (2013.01); *E05B 83/36* (2013.01); ***E05B 81/64*** (2013.01); *E05F 15/646* (2015.01)

(58) **Field of Classification Search**

CPC E05F 15/40; E05F 15/41; E05F 15/42; E05Y 2400/44; E05Y 2400/53; E05Y 2400/54; E05Y 2400/55; B60J 5/04; B60J 5/047; B60J 5/0472; B60J 5/06; B60Q 9/00

USPC 296/1.04, 146.9, 146.11, 155; 49/26, 49/27, 28; 16/362

See application file for complete search history.

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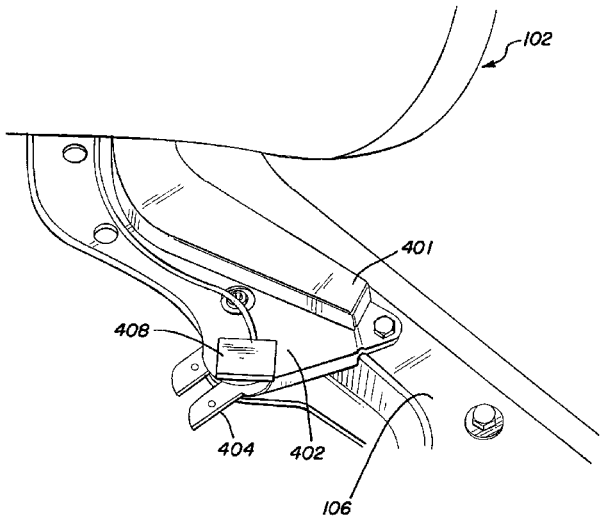
(57) **ABSTRACT**

Obstacle detection for a sliding door of a vehicle including a sensor apparatus located on or near a hinge of the sliding door and arranged to detect an obstacle in a path of the hinge of the sliding door. A controller connected to the sensor apparatus is configured to receive an obstruction signal from the sensor apparatus indicating detection of an obstacle in the path of the hinge of the sliding door.

18 Claims, 8 Drawing Sheets



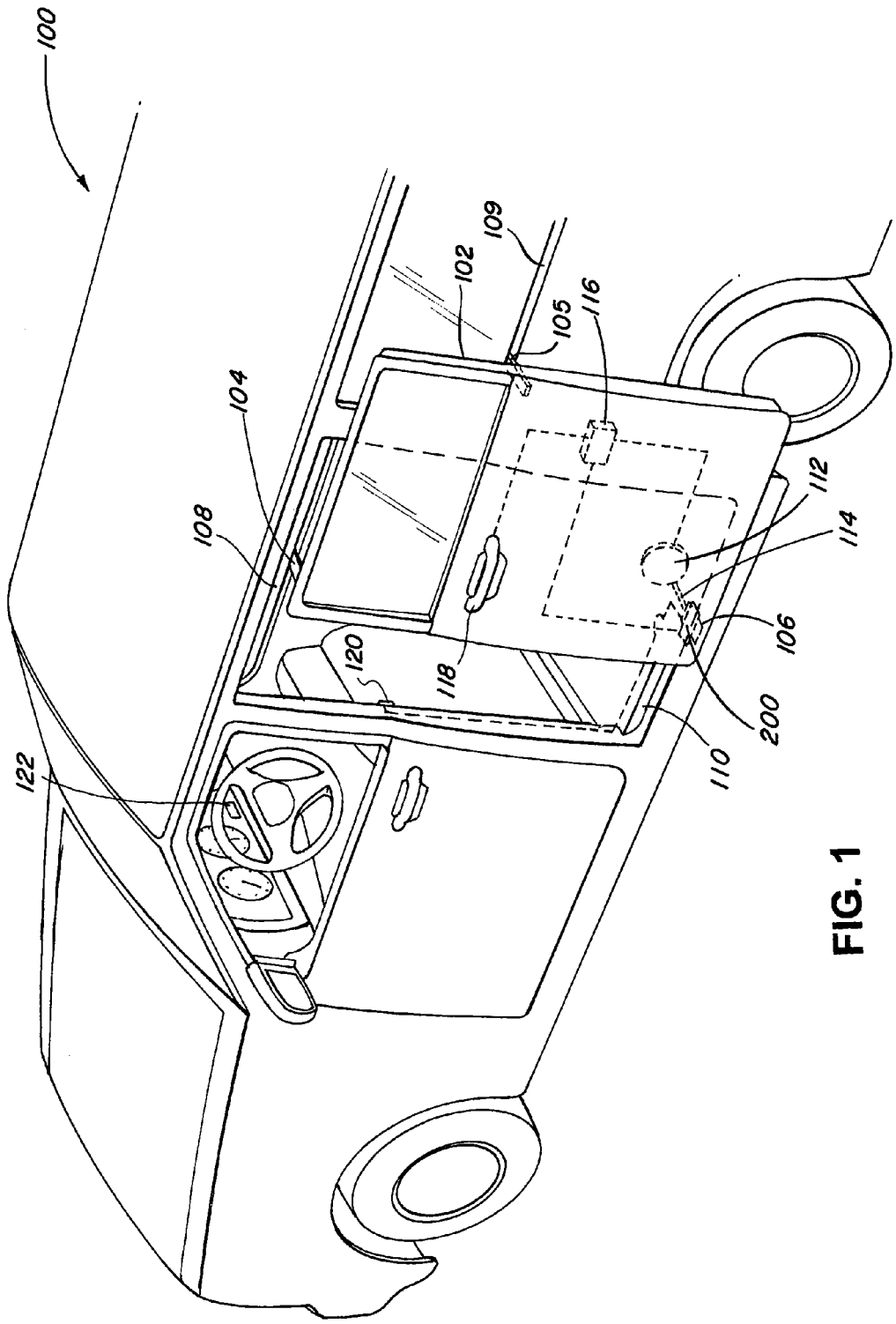


FIG. 1

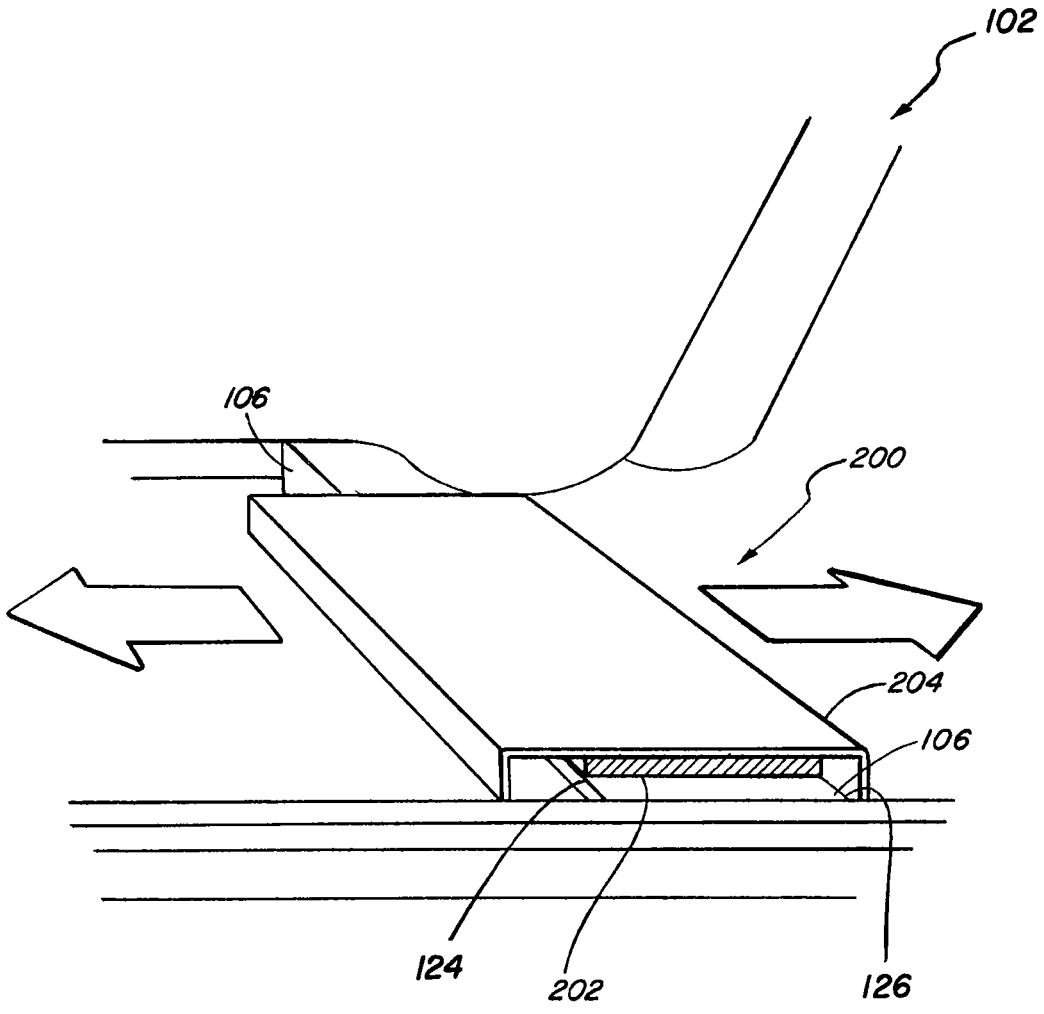


FIG. 2A

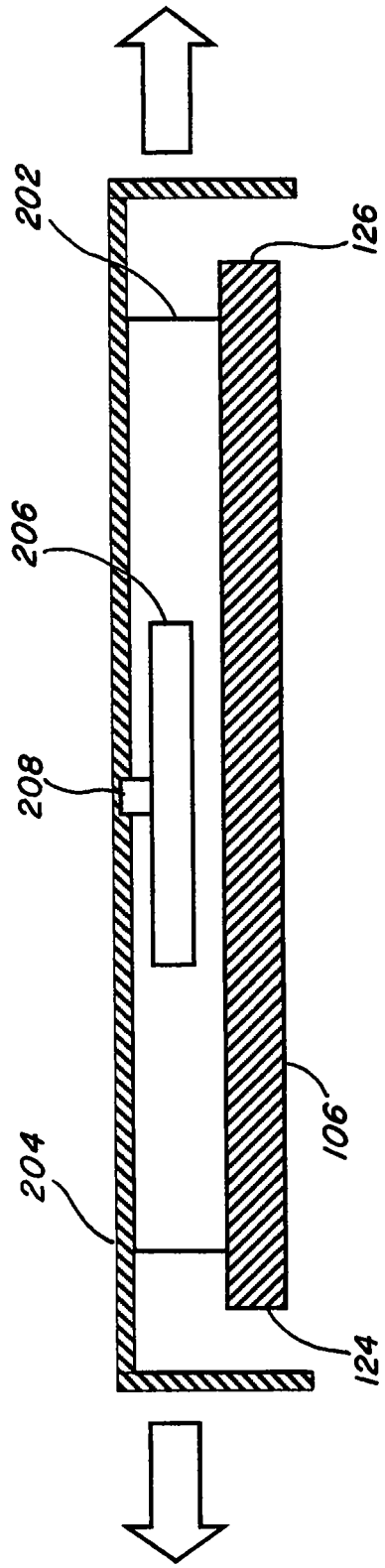


FIG. 2B

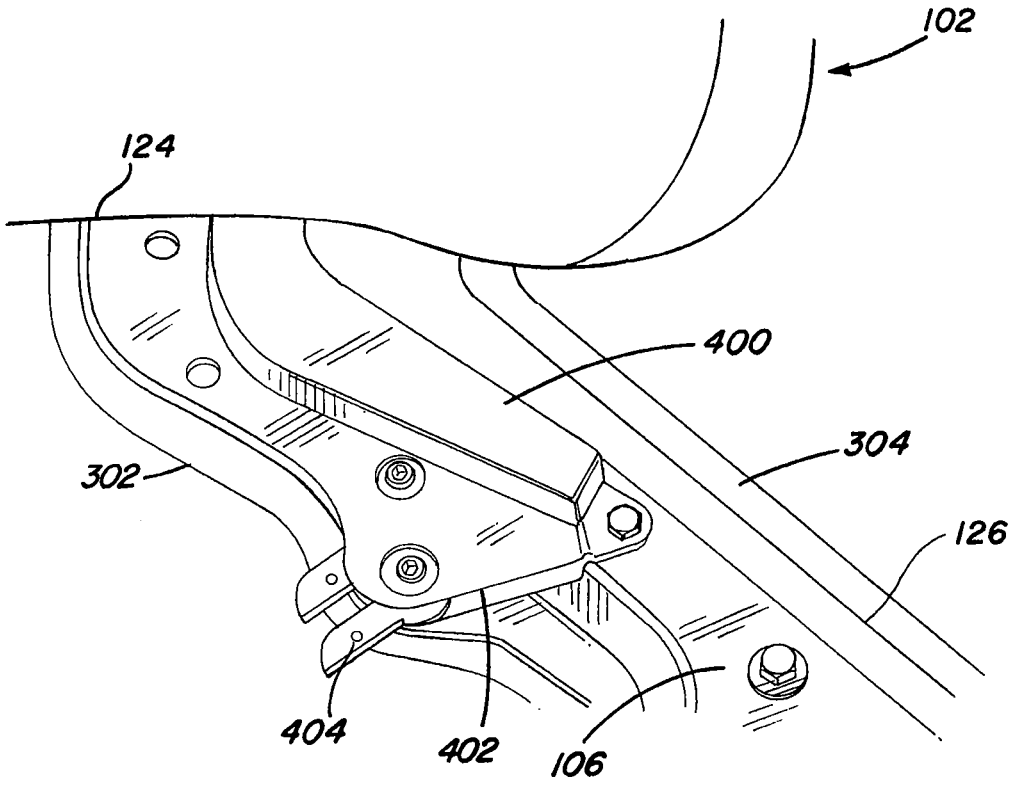


FIG. 3

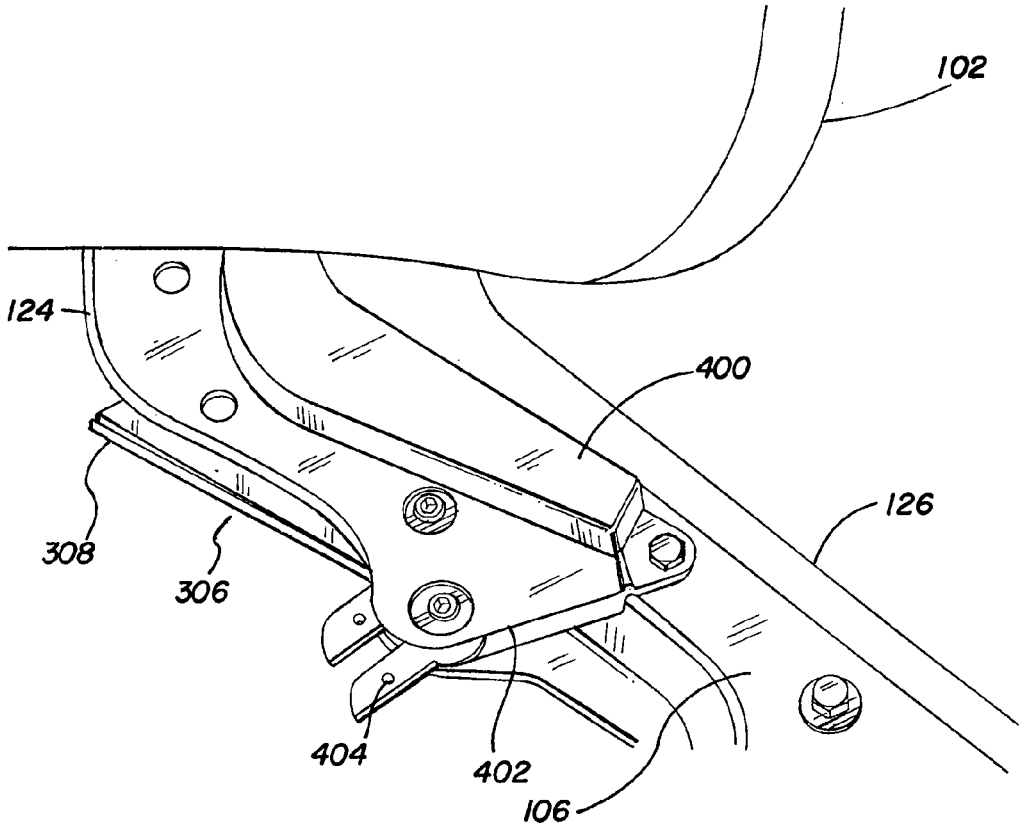


FIG. 4

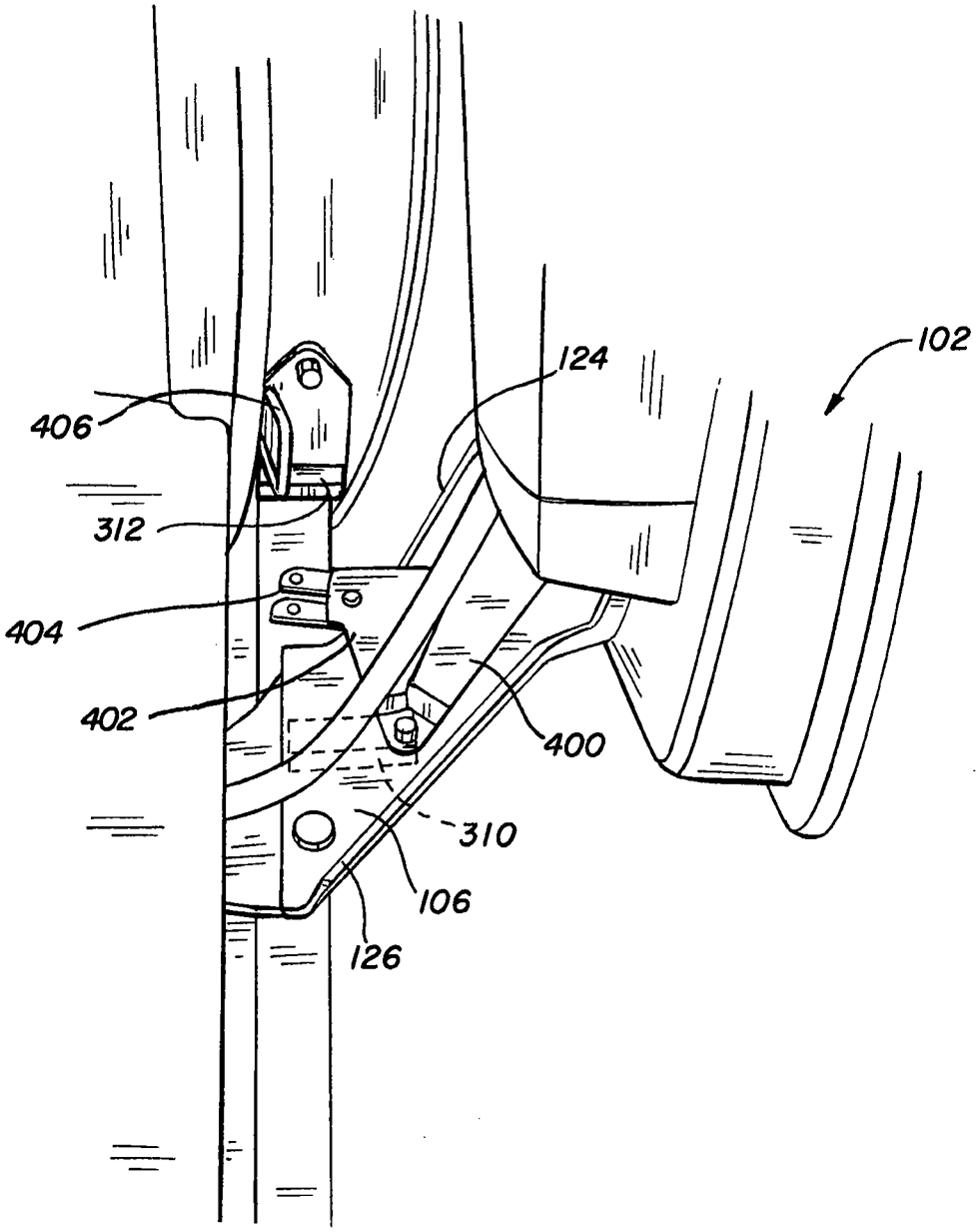


FIG. 5

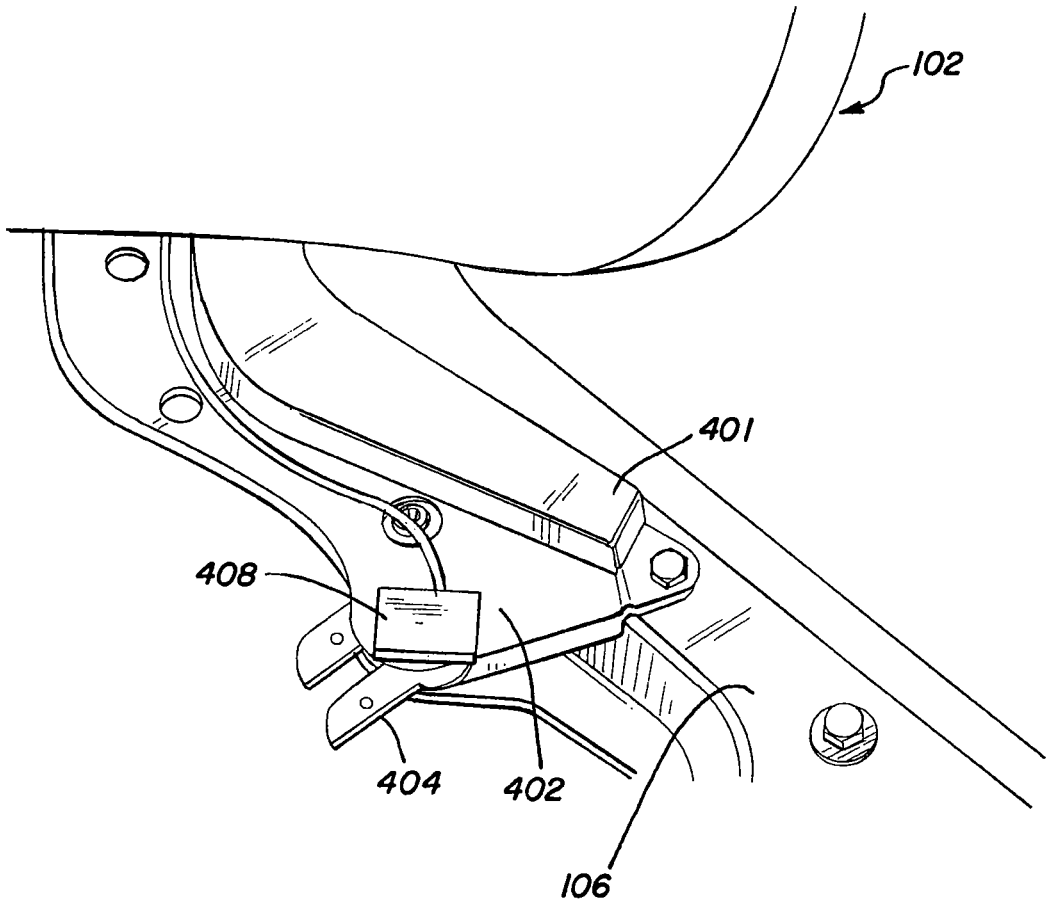


FIG. 6

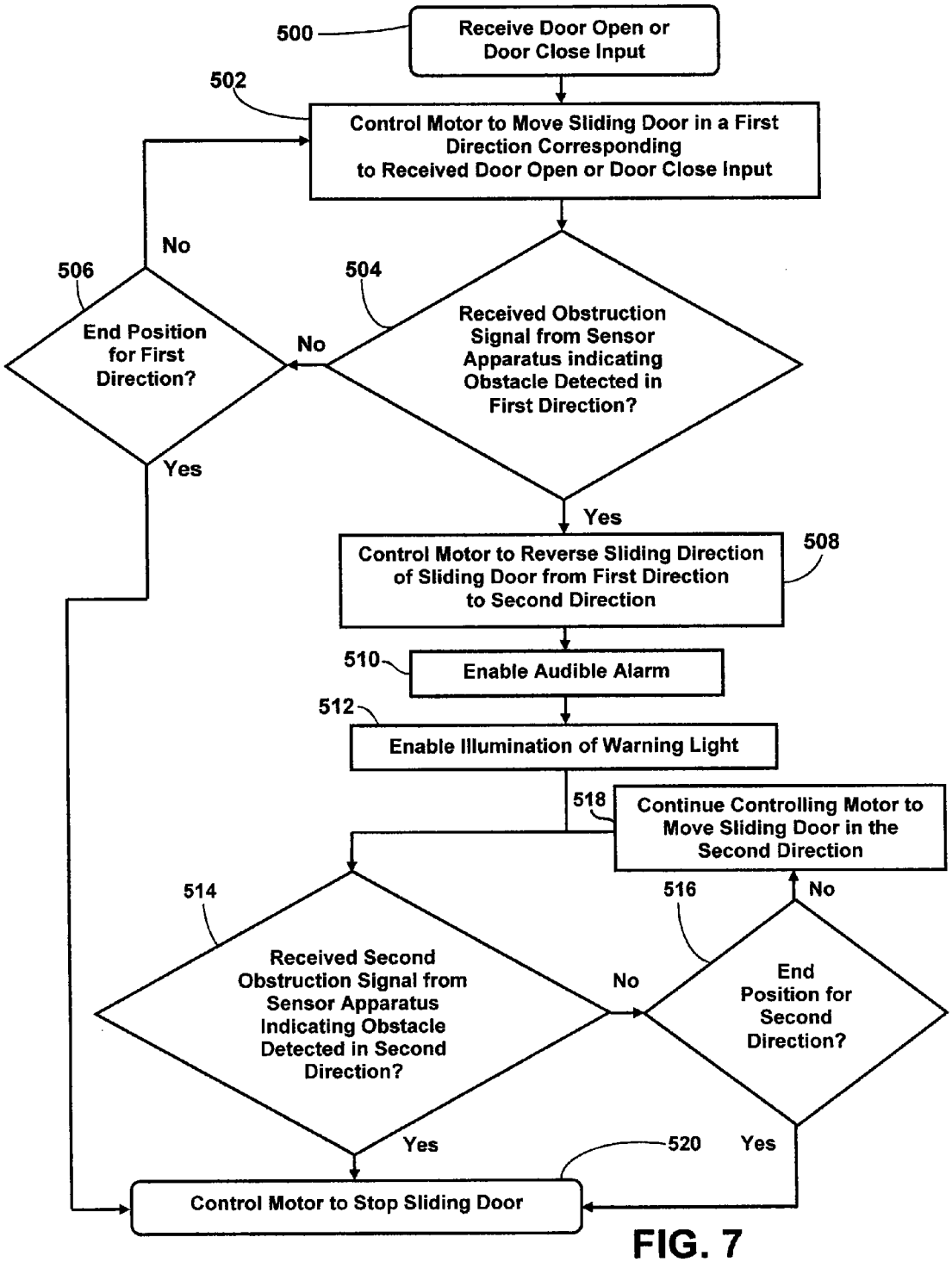

500
Receive Door Open or Door Close Input
502
Control Motor to Move Sliding Door in a First Direction Corresponding to Received Door Open or Door Close Input
504
Received Obstruction Signal from Sensor Apparatus indicating Obstacle Detected in First Direction?
No
506
End Position for First Direction?
No
Yes
Yes
508
Control Motor to Reverse Sliding Direction of Sliding Door from First Direction to Second Direction
510
Enable Audible Alarm
512
Enable Illumination of Warning Light
518
Continue Controlling Motor to Move Sliding Door in the Second Direction
514
Received Second Obstruction Signal from Sensor Apparatus Indicating Obstacle Detected in Second Direction?
No
516
End Position for Second Direction?
No
Yes
Yes
520
Control Motor to Stop Sliding Door

FIG. 7

SLIDING DOOR OBSTACLE DETECTION

FIELD

The present disclosure relates to a sliding door of a vehicle, and more particularly, to a system and method for obstacle detection for the sliding door.

BACKGROUND

Vehicles such as vans often include a sliding door connected to the vehicle body with hinges. As the sliding door opens and closes, the hinges slide along door tracks on the vehicle body and a gap forms between the vehicle body and the sliding door. Some sliding doors may be powered by a motor to allow the sliding door to automatically open and close with the push of a button or by other electrical inputs. In such automatic sliding doors, an unexpected slowing in the motor speed may be used as an indicator that an object is obstructing the sliding door.

SUMMARY

In addition to, or in place of conventional obstacle detection systems discussed above, the present disclosure relates to obstacle detection in a path of a hinge of a sliding door. In particular, one embodiment of the present disclosure includes a sensor apparatus located on or near a hinge of a sliding door and arranged to detect an obstacle in a path of the hinge of the sliding door. A controller connected to the sensor apparatus is configured to receive an obstruction signal from the sensor apparatus indicating detection of an obstacle in the path of the hinge of the sliding door. By having the sensor apparatus located on or near a hinge of the sliding door, it is ordinarily possible to quickly and accurately detect an obstacle in the path of the hinge. In a further embodiment, the sensor apparatus is located on or near a lower hinge of the sliding door.

According to another embodiment, a sensor apparatus for detecting an obstacle in a path of a hinge of a sliding door includes a contact body slidably mounted on the hinge of the sliding door. At least one edge of the contact body extends beyond an edge of the hinge into the path of the hinge. The sensor apparatus also includes a sensor arranged to detect motion of the contact body relative to the hinge of the sliding door. In a further embodiment, the sensor includes a bidirectional switch arranged to detect motion of the contact body in a first direction relative to the hinge and to detect motion of the contact body in a second direction relative to the hinge. The detection of motion in the first direction by the sensor corresponds to detection of an obstacle as the hinge moves in the second direction in the path of the hinge. Similarly, the detection of motion in the second direction by the sensor corresponds to detection of an obstacle as the hinge moves in the first direction in the path of the hinge.

According to another embodiment, a hinge assembly for a sliding door includes a hinge connecting the sliding door with a door track of the vehicle. A first sensor apparatus is mounted adjacent a first edge of the hinge and extends into a path of the hinge. The first sensor apparatus is arranged to detect an obstacle in the path of the hinge. In a further embodiment, a second sensor apparatus is mounted adjacent a second edge of the hinge and extends into the path of the hinge in a substantially opposite direction from the first sensor apparatus. By virtue of having the first sensor apparatus mounted on the first edge and the second sensor apparatus mounted on the second edge, obstacles can ordinarily be detected in both directions in the path of the hinge.

In yet another embodiment, a latch assembly capable of detecting an obstacle in a path of a hinge of a sliding door includes a latch cover mounted on the hinge of the sliding door. A latch is constructed to move within the latch cover and a sensor apparatus is arranged to detect movement of the latch with respect to the latch cover. By detecting movement of the latch, it is usually possible to quickly and accurately detect an obstacle in the path of the hinge.

BRIEF DESCRIPTION OF THE DRAWINGS

The features and advantages of the embodiments of the present disclosure will become more apparent from the detailed description set forth below when taken in conjunction with the drawings. Naturally, the drawings and their associated descriptions illustrate example arrangements within the scope of the claims and do not limit the scope of the claims. Reference numbers are reused throughout the drawings to indicate correspondence between referenced elements.

FIG. **1** depicts a vehicle with a sliding door according to an embodiment of the present disclosure.

FIG. **2**A is a perspective view of a sensor apparatus mounted on a hinge according to an embodiment of the present disclosure.

FIG. **2**B is a cross section view of the sensor apparatus and hinge of FIG. **2**A.

FIG. **3** depicts a hinge assembly with a sensor apparatus according to an embodiment of the present disclosure.

FIG. **4** depicts a hinge assembly with a sensor apparatus including a switch according to an embodiment of the present disclosure.

FIG. **5** depicts a hinge assembly with a sensor apparatus including a light sensor according to an embodiment of the present disclosure.

FIG. **6** depicts a latch assembly with a sensor apparatus according to an embodiment of the present disclosure.

FIG. **7** is a flowchart for an obstacle detection process according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

In the following detailed description, numerous specific details are set forth to provide a full understanding of the present disclosure. It will be apparent, however, to one ordinarily skilled in the art that the present invention may be practiced without some of these specific details. In other instances, well-known structures and techniques have not been shown in detail to avoid unnecessarily obscuring the present disclosure.

FIG. **1** depicts a vehicle **100** with a sliding door **102** according to an example embodiment. The vehicle **100** may be any vehicle with a sliding door, such as a minivan or sedan. As shown in FIG. **1**, the sliding door **102** is in a partially open position, with a fully open position being where the sliding door **102** is fully slid toward the rear of the vehicle **100**. In the embodiment of FIG. **1**, the sliding door **102** is connected to the vehicle **100** by an upper hinge **104**, a middle hinge **105**, and a lower hinge **106**. The upper hinge **104** slides in an upper door track **108** in the body of the vehicle **100**. Similarly, the middle hinge **105** slides in a middle door track **109** and the lower hinge **106** slides in a lower door track **110**. The sliding door **102** is a powered sliding door which is capable of opening and closing in response to an input, such as an input received from a key fob (not shown) or from a door open/close button **120** inside the vehicle **100**. As will be appreciated by those of ordinary skill in the art, the obstacle detection dis-

closed herein is not limited to powered sliding doors and may involve sliding doors that are manually opened or closed.

As a powered sliding door, the sliding door **102** includes a motor **112** that is mechanically coupled to a conveying mechanism **114**, such as a belt, cable or gear to propel the sliding door **102** along the lower door track **110**. In some embodiments, the conveying mechanism **114** may propel the sliding door along other door tracks, such as the upper door track **108** or the middle door track **109**. A controller **116** supplies a control signal to the motor **112** so as to control the motor **112** to drive the conveying mechanism **114** in a forward or reverse direction, thereby automatically opening or closing the sliding door **102**. The controller **116** may include a processor and a computer readable medium residing in an Application Specific Integrated Circuit (ASIC). In some embodiments, the controller **116** can be integrated with the motor **112**.

In the embodiment of FIG. **1**, a handle **118** is electrically connected to the controller **116** so as to provide a signal to the controller **116** indicating when the sliding door has been unlatched from a fully closed position or when the sliding door **102** has been unlatched from a fully open position. The controller **116** is also electrically connected to the door open/close button **120** and to a sensor apparatus **200** mounted on the lower hinge **106**.

In the present disclosure, mounted on can refer to mounting directly or indirectly onto a surface, regardless of the orientation of the surface, so as to include bottom, top and side surfaces. In addition, the sensor apparatuses of the present disclosure are not limited to an area on or near a lower hinge of a sliding door. As will be appreciated by those of ordinary skill in the art, the sensor apparatuses of the present disclosure may also be located on or near other hinges, such as the upper hinge **104** and/or the middle hinge **105**.

The sensor apparatus **200** communicates detection of an obstacle in the path of the lower hinge **106** to the controller **116**, and in turn, the controller **116** can, for example, reverse a direction of the motor **112**, stop the motor **112**, or briefly reverse the direction of the motor **112** before stopping the motor **112**. The controller **116** may enable illumination of a warning light **122** inside the vehicle **100** and/or enable an audible alarm after receiving an obstruction signal from the sensor apparatus **200** indicating detection of an obstacle. Such an audible alarm can sound through speakers (not shown) located within the vehicle **100**. This is further described below with reference to the obstacle detection process of FIG. **7**. In some embodiments, the controller **116** may only enable illumination of the warning light **122** and/or enable an audible alarm without Controlling the motor **112**.

FIG. **2**A is a perspective view of the sensor apparatus **200** mounted on the lower hinge **106** according to one embodiment. The sensor apparatus **200** includes a contact body **204** and a base **202**, which is mounted on the lower hinge **106**. In the embodiment of FIG. **2**A, the contact body **204** is slidably mounted on the lower hinge **106** via the base **202**, which is fixed to the lower hinge **106**. The base **202** may be, for example, composed of a smooth material such as a plastic resin. The contact body **204** can slide in the directions indicated by the opposing arrows shown in FIG. **2**A. These arrows indicate a first and a second direction in a path of the lower hinge **106** as the sliding door **102** opens or closes.

As shown in FIG. **2**A, the contact body **204** extends beyond a first edge **124** and beyond a second edge **126** of the lower hinge **106**. Since the contact body **204** extends beyond the lower hinge **106** into the path of the lower hinge **106**, the contact body **204** ordinarily contacts an obstacle in the path of the lower hinge **106** before the obstacle contacts the lower hinge **106**. In addition, the ends of the contact body **204** that extend into the path bend downward to provide a larger surface for contacting an obstacle in the path of the lower hinge **106**. However, in some embodiments, the ends of the contact body **204** can bend upwards or may not be bent at all. In this regard, the sensor apparatus **200** can also be located below the lower hinge **106** instead of being located above the lower hinge **106**.

FIG. **2**B is a cross section view of the sensor apparatus **200** and the lower hinge **106** of FIG. **2**A. As shown in FIG. **2**B, the base **202** is located between the contact body **204** and the hinge **106**. Although FIG. **2**B depicts the base **202** in contact with the contact body **204**, there may be a gap between the base **202** and the contact body **204** in some embodiments.

In FIG. **2**B, the base **202** houses most of a sensor **206** which is arranged to detect motion of the contact body **204** relative to the lower hinge **106** and the base **202**. Such motion ordinarily occurs when an obstacle in the path of the lower hinge **106** contacts the contact body **204**. In the example of FIG. **2**B, the sensor **206** includes a lever **208** of a bidirectional switch that is connected to the contact body **204** and is biased to a center position. In operation, when the contact body **204** contacts an obstacle in the path of the lower hinge **106**, the lever **208** slides with the contact body **204** and generates an obstruction signal which is transmitted to the controller **116**. By having a bidirectional switch, the sensor **206** can ordinarily detect motion of the contact body **204** in both directions indicated by the arrows in FIG. **2**B, and can thereby indicate on which side of the lower hinge **106** an obstacle has been detected. In some embodiments, the sensor **206** may only detect motion of the contact body **204** in a single direction by using, for example, a single unidirectional switch.

In some embodiments, the locations of the sensor **206** and/or the base **202** may vary depending upon the design of the lower hinge **106** or other design considerations. In one example embodiment, the bidirectional switch of the sensor **206** may be replaced by two separate switches for generating two different obstruction signals corresponding to obstacle detection on different sides of the contact body **204**. In some embodiments, the sensor **206** may include a potentiometer or rotary switch with a corresponding lever or rotor arranged similarly to the lever **208**. In the case where the sensor **206** includes a rotary switch, the sensor **206** generates an obstruction signal upon rotation of the contact body **204** relative to the lower hinge **106** and the base **202**.

FIG. **3** depicts a hinge assembly for detecting an obstacle in the path of the lower hinge **106**. In addition, FIG. **3** also depicts a latch assembly **400** mounted on the lower hinge **106**. The latch assembly **400** includes a latch cover **402** and a latch **404** for holding the sliding door **102** in a fully open position when the latch **404** couples with a striker **406** (shown in FIG. **5**).

The hinge assembly of FIG. **3** includes the lower hinge **106**, a first sensor apparatus **302** mounted on the first edge **124** of the lower hinge **106**, and a second sensor apparatus **304** mounted on the second edge **126** of the lower hinge **106**. As shown in FIG. **3**, the first sensor apparatus **302** and the second sensor apparatus **304** are mounted along a substantial portion of the first edge **124** and the second edge **126**, respectively. In some embodiments, the first sensor apparatus **302** and/or the second sensor apparatus **304** may only be mounted along specific portions of the first edge **124** and/or the second edge **126**.

As shown in FIG. **3**, the first sensor apparatus **302** extends into the path of the lower hinge **106** in a first direction while the second sensor apparatus **304** extends into the path of the lower hinge **106** in a second direction substantially opposite

the first direction. In the embodiment of FIG. **3**, the first sensor apparatus **302** and the second sensor apparatus **304** are wire-type contact sensors which include a hollow rubber body having wires arranged inside so as to contact each other when the hollow rubber body is compressed. In some embodiments, the first sensor apparatus **302** and/or the second sensor apparatus **304** can be a capacitive contact sensor instead of a wire-type contact sensor. As with the sensor apparatus of FIGS. **2**A and **2**B, the first sensor apparatus **302** and the second sensor apparatus **304** are electrically connected to the controller **116** so as to provide an obstruction signal to the controller **116** indicating detection of an obstacle in the path of the lower hinge **106**.

As will be appreciated by those of ordinary skill in the art, either the first sensor apparatus **302** or the second sensor apparatus **304** can be omitted without departing from the spirit or scope of the present disclosure.

FIG. **4** depicts a hinge assembly that includes the lower hinge **106** and a sensor apparatus **306** for detecting an obstacle in the path of the lower hinge **106**. In the example embodiment of FIG. **4**, the sensor apparatus **306** is a contact switch mounted adjacent the first edge **124** of the lower hinge **106**. The sensor apparatus **306** includes a contact lever **308** which extends into the path of the lower hinge **106**. In operation, the sensor apparatus **306** generates an obstruction signal that is sent to the controller **116** when an object contacts the contact lever **308**.

FIG. **5** depicts a hinge assembly that includes the lower hinge **106** and a sensor apparatus **310** mounted on the bottom of the lower hinge **106**. The sensor apparatus **310** is a light curtain sensor that receives light from a light transmitter **312** located near an end of the path of the lower hinge **106**. In operation, the sensor apparatus **310** sends an obstruction signal to the controller **116** when light transmitted from the light transmitter **312** is not received by the sensor apparatus **310**. In some embodiments, the sensor apparatus **312** can be located in other positions on or near a hinge depending upon the location of the light transmitter **312**.

As with the latch assembly **400** of FIGS. **3** through **5**, a latch assembly **401** of FIG. **6** includes a latch cover **402** and a latch **404**. However, the latch assembly **401** of FIG. **6** differs from the latch assembly **400** in that it includes a sensor apparatus **408** arranged to detect movement of the latch **404** with respect to the latch cover. In this regard, the sensor apparatus **408** can include various devices to detect movement of the latch **404**, such as a rotary switch, standard switch, or potentiometer that can be activated directly by the latch **404** or by an internal component of the latch assembly **401**. In operation, the sensor apparatus **408** sends an obstruction signal to the controller **116** when the sensor apparatus **408** detects movement of the latch **404**. The controller **116** determines that the latch **404** has encountered an obstacle in the path of the lower hinge **106** if the sliding door **102** has not reached its fully open position. The position of the sliding door **102** can be obtained, for example, by using position sensors along the upper door track **108** or along the lower door track **110**, or by calculation of known relationships between the speed of the motor **112** and the length of the lower door track **110**.

FIG. **7** is a flowchart for an obstacle detection process performed by the controller **116** according to an example embodiment. In block **500**, the controller **116** receives a door open or a door close input, such as from the door open/close button **120** or from the handle **118**. In response to the door open or door close input, the controller **116** in block **502** controls the motor **112** to move the sliding door **102** in a first direction corresponding to the received door open or door close input. For example, if the sliding door **102** is in a closed position, the controller **116** receives a door open input when the door open/close button **120** is pressed. The motor **112** is then controlled by the controller **116** in block **502** so that the sliding door **102** opens toward the rear of the vehicle **100**. On the other hand, if the sliding door is in the fully open position, the controller **116** receives a door close input when the door open/close button **120** is pressed.

In block **504**, the controller **116** checks whether it has received an obstruction signal from the sensor apparatus indicating detection of an obstacle in the first direction of the path of the lower hinge **106**. If no obstruction signal has been received in block **504**, the process proceeds to block **506** and the controller **116** determines whether the sliding door **102** has reached an end position for the first direction. As noted above with reference to FIG. **6**, the controller **116** can determine whether the sliding door **102** has reached a fully open position or a fully closed position by using, for example, a position sensor along a door track, or by calculation of known relationships between the speed of the motor **112** and the length of the lower door track **110**. If the controller **116** determines in block **506** that the end position for the first direction has been reached, the controller **116** controls the motor **112** to stop the sliding door **102** in block **520**. If the controller **116** determines in block **506** that the end position for the first direction has not been reached, the process returns to block **502** to continue moving the sliding door **102** in the first direction.

Returning to block **504**, if the controller **116** receives an obstruction signal indicating detection of an obstacle in the first direction, the controller **116** controls the motor **112** to reverse its direction so as to move the sliding door **102** in a second direction opposite the first direction. In alternative embodiments, the controller **116** may control the motor **112** so as to take a different action, such as stopping the sliding door **102**. After block **508**, the controller **116** enables an audible alarm through speakers of the vehicle **100** in block **510**. The controller **116** also enables illumination of the warning light **122** in block **512**. In alternative embodiments, blocks **510** and/or **512** may be omitted.

In block **514**, the controller **116** determines whether a second obstruction signal is received indicating that an obstacle is detected in the second direction as the sliding door **102** reverses its direction. If the controller **116** receives a second obstruction signal in block **514**, the controller **116** controls the motor **112** to stop the sliding door **102** in block **520**. On the other hand, if the controller **116** does not receive a second obstruction signal in block **514**, the controller **116** checks whether the sliding door **102** has reached an end position for the second direction in block **516**. As with the end position for the first direction in block **506**, the end position for the second direction in block **516** is either the fully open door position or the fully closed door position. In alternative embodiments, the controller **116** may control the motor **112** to stop the sliding door **102** before reaching the end position for the second direction.

If the controller **116** determines in block **516** that the sliding door **102** has reached the end position for the second direction, the controller **116** controls the motor **112** to stop the sliding door **102** in block **520**. If not, the process proceeds to block **518** to continue controlling the motor **112** to move the sliding door **102** in the second direction and the process returns to block **514**.

Those of ordinary skill will appreciate that the various illustrative logical blocks and process steps described in connection with the examples disclosed herein may be implemented as electronic hardware, computer software, or combinations of both. Whether such functionality is implemented

as hardware or software depends upon the particular application and design constraints imposed on the overall system. Ordinarily skilled artisans may implement the described functionality in varying ways for each particular application, but such implementation decisions should not be interpreted as causing a departure from the scope of the disclosed apparatuses and methods.

The steps of a method or algorithm described in connection with the examples disclosed herein may be embodied directly in hardware, in a software module executed by a processor, or in a combination of the two. A software module may reside in RAM memory, flash memory, ROM memory, EPROM memory, EEPROM memory, registers, hard disk, a removable disk, a CD-ROM, or any other form of storage medium known in the art. An exemplary storage medium is coupled to the processor such that the processor can read information from, and write information to, the storage medium. In the alternative, the storage medium may be integral to the processor. The processor and the storage medium may reside in an Application Specific Integrated Circuit (ASIC).

The foregoing description of the disclosed example embodiments is provided to enable any person of ordinary skill in the art to make or use the claimed invention. Various modifications to these examples will be readily apparent to those of ordinary skill in the art, and the principles disclosed herein may be applied to other examples without departing from the spirit or scope of the claims. The described embodiments are to be considered in all respects only as illustrative and not restrictive and the scope of the invention is, therefore, indicated by the following claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

What is claimed is:

1. An obstacle detection system for a sliding door of a vehicle, the obstacle detection system comprising:

a door track coupled to the vehicle;

a hinge having a proximal end coupled to the door track and configured to move along the door track and a distal end connected to the sliding door, such that when the sliding door is open, the distal end is extending from the vehicle;

a sensor directly connected to the hinge and configured to detect an obstacle in a path of the hinge; and

a controller coupled to the sensor and configured to receive an obstruction signal from the sensor in response to the sensor detecting that the obstacle is in the path of the hinge.

2. The obstacle detection system of claim **1**, wherein the hinge is a lower hinge of the sliding door.

3. The obstacle detection system of claim **1**, wherein the controller is configured to control a motor of the sliding door to stop or to reverse a sliding direction of the sliding door from a first direction to a second direction in response to receiving the obstruction signal.

4. The obstacle detection system of claim **3**, wherein the controller is configured to receive a second obstruction signal from the sensor when a second obstacle is in the path of the hinge in the second direction and control the motor of the sliding door to stop the sliding door from sliding in the second direction in response to receiving the second obstruction signal.

5. The obstacle detection system of claim **1**, wherein the sensor comprises:

a first sensor configured to detect a first obstacle in the path of the hinge in a first direction; and

a second sensor configured to detect a second obstacle in the path of the hinge in a second direction.

6. The obstacle detection system of claim **1**, wherein the sensor further comprises at least one of a wire-type contact sensor, a capacitive contact sensor, a switch, or a light sensor configured to detect an obstacle in the path of the hinge of the sliding door.

7. The obstacle detection system of claim **1**, wherein the controller is configured to enable an audible alarm or an illumination of a warning light in response to receiving the obstruction signal.

8. A system for detecting an obstacle in a path of a hinge of a sliding door of a vehicle having a door track, the system comprising:

a hinge having a proximal end coupled to the door track and configured to move along the door track and a distal end connected to the sliding door, such that when the sliding door is open, the distal end is extending from the vehicle;

a contact body slidably mounted on the hinge such that at least one edge of the contact body extends beyond an edge of the hinge into the path of the hinge; and

a sensor configured to detect motion of the contact body relative to the hinge.

9. The system of claim **8**, wherein the hinge is a lower hinge of the sliding door.

10. The system of claim **8**, wherein the sensor includes a bidirectional switch configured to detect motion of the contact body in a first direction relative to the hinge and to detect motion of the contact body in a second direction relative to the hinge;

whereby detection of motion in the first direction by the sensor corresponds to detection of an obstacle as the hinge moves in the second direction in the path of the hinge and detection of motion in the second direction by the sensor corresponds to detection of an obstacle as the hinge moves in the first direction in the path of the hinge.

11. The system of claim **8**, wherein the sensor includes at least two switches configured to detect motion of the contact body relative to the hinge.

12. The system of claim **8**, wherein the sensor includes a rotary switch or a potentiometer configured to detect motion of the contact body relative to the hinge.

13. The system of claim **8**, further comprising a base located between the contact body and the hinge and configured to house at least a portion of the sensor.

14. A hinge assembly for a sliding door of a vehicle, the hinge assembly comprising:

a door track coupled to the vehicle;

a hinge having a first edge, a proximal end coupled to the door track and configured to move along the door track and a distal end connected to sliding door, such that when the sliding door is open, the distal end is extending from the vehicle; and

a first sensor mounted adjacent the first edge of the hinge, extending into a path of the hinge and configured to detect an obstacle in the path of the hinge.

15. The hinge assembly of claim **14**, wherein the hinge couples a lower portion of the sliding door with the door track.

16. The hinge assembly of claim **14**, further comprising a second sensor mounted adjacent a second edge of the hinge and extending into the path of the hinge in a substantially opposite direction from the first sensor.

17. The hinge assembly of claim **14**, wherein the first sensor comprises at least one of a wire-type contact sensor, a capacitive contact sensor, a switch, or a light sensor configured to detect an obstacle in the path of the hinge.

18. A system for detecting an obstacle in a path of a hinge of a sliding door, the system comprising:

a contact body slidably mounted on the hinge such that at least one edge of the contact body extends beyond an edge of the hinge into the path of the hinge; and

a sensor including a bidirectional switch configured to detect motion of the contact body in a first direction relative to the hinge and to detect motion of the contact body in a second direction relative to the hinge.

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